

**WHAT IS CLAIMED IS:**

1    1. A road lane marker recognition apparatus for  
2    obtaining a forward road image of a road ahead of a vehicle  
3    with an imaging device and estimating road parameters of  
4    a road model equation, the recognition apparatus  
5    comprising a processor:

6         to set, in the road image, a plurality of windows along  
7         a road lane marker on the road so that the road lane  
8         marker is contained in each window;

9         to calculate a candidate lane marker which is likely to  
10      be the road lane marker in each window;

11         to judge an accuracy in determining the position of  
12      the candidate lane marker with respect to the road lane  
13      marker in each window; and

14         to estimate the road parameters of the road model  
15      equation representing a road shape of the road and vehicle  
16      attitude with respect to the road, the processor being  
17      configured to estimate the road parameters inclusive of a  
18      vehicle lateral displacement, by using at least a gradient of  
19      the candidate lane marker for one window judged to be  
20      lower in the accuracy, and by using an image coordinate of  
21      the candidate lane marker for one window judged to be  
22      higher in the accuracy.

1    2. The recognition apparatus as claimed in Claim 1,  
2    wherein the processor is configured to examine each  
3    window to determine whether there is a pseudo lane  
4    marker approximately equal in gradient to the candidate  
5    lane marker, and to judge a window to be lower in the  
6    accuracy if there is the pseudo lane marker, and to be  
7    higher in the accuracy if there is not the pseudo lane  
8    marker.

1   3.   The recognition apparatus as claimed in Claim 1,  
2   wherein the processor is configured to judge the accuracy  
3   of each window in accordance with a distance of a road  
4   region in the window from the vehicle, and to judge a  
5   window to be lower in the accuracy if the distance is  
6   greater, and to be higher in the accuracy if the distance is  
7   smaller.

1   4.   The recognition apparatus as claimed in Claim 1,  
2   wherein the processor is configured to extract candidate  
3   lane marker points by processing the image in each window,  
4   and to calculate the candidate lane marker from the  
5   candidate lane marker points in each window.

1   5.   The recognition apparatus as claimed in Claim 1,  
2   wherein the processor is configured to calculate the  
3   candidate lane marker in each window by straight line  
4   approximation.

1   6.   The recognition apparatus as claimed in Claim 4,  
2   wherein the processor is configured to calculate the  
3   candidate lane marker by straight line approximation using  
4   Hough transform from the candidate lane marker points in  
5   each window.

1   7.   The recognition apparatus as claimed in Claim 1,  
2   wherein the processor is configured to subject an equation  
3   obtained by eliminating the vehicle lateral displacement  
4   from the road model equation, to linear approximation  
5   about the parameters, for a window judged to be lower in  
6   the position accuracy, and to subject the road model  
7   equation to linear approximation about the parameters, for  
8   a window judged to be higher in the position accuracy, to  
9   estimate the road parameters by Kalman filter operation.

1 8. The recognition apparatus as claimed in Claim 1,  
2 wherein the road parameters comprise a road curvature, a  
3 yaw angle of the vehicle with respect to a road lane, a  
4 pitch angle of the vehicle, and a height of the imaging  
5 device from a ground level.

1 9. The recognition apparatus as claimed in Claim 1,  
2 wherein the processor is configured to classify the windows  
3 into a higher accuracy window subset and a lower accuracy  
4 window subset in accordance with the position accuracy,  
5 and the processor is further configured to estimate the  
6 road parameters exclusive of the vehicle lateral  
7 displacement, by using the gradient of the candidate lane  
8 marker for each window or the window of the lower  
9 accuracy window subset, and to estimate the road  
10 parameters inclusive of the vehicle lateral displacement for  
11 each window or the window of the higher accuracy window  
12 subset.

1 10. A road lane marker recognition process comprising:  
2 obtaining a forward road image of a road ahead of a  
3 vehicle;  
4 setting, in the road image, a series of windows  
5 arranged along a road lane marker on the road so that the  
6 road lane marker is contained in each window;  
7 calculating a candidate lane marker which is likely to  
8 be the lane marker in each window;  
9 judging a position accuracy in position of the  
10 candidate lane marker with respect to the road lane marker  
11 in each window; and  
12 estimating road parameters of a road model equation  
13 representing a road shape of the road and vehicle attitude  
14 with respect to the road, the road parameters inclusive of a  
15 vehicle lateral displacement being estimated by using at  
16 least a gradient of the candidate lane marker for one

17 window judged to be lower in the position accuracy, and by  
18 using an image coordinate of the candidate lane marker for  
19 one window judged to be higher in the position accuracy.

1 11. A road lane marker recognition apparatus comprising:  
2 means for setting, in a forward road image of a road  
3 ahead of a vehicle, a series of windows along a road lane  
4 marker on the road so that the road lane marker is  
5 contained in each window;  
6 means for calculating a candidate lane marker which  
7 is likely to be the road lane marker in each window;  
8 means for judging a position accuracy in position of  
9 the candidate lane marker in each window; and  
10 means for estimating road parameters of a road model  
11 equation, inclusive of a vehicle lateral displacement, by  
12 using at least a gradient of the candidate lane marker for  
13 one window judged to be lower in the position accuracy,  
14 and by using an image coordinate of the candidate lane  
15 marker for one window judged to be higher in the position  
16 accuracy.